NSF Sponsored Workshop on Tether-free Technologies for e-Manufacturing and e-Maintenance/Service

IEEE 802.15.4 Low Rate Wireless Personal Area Networks

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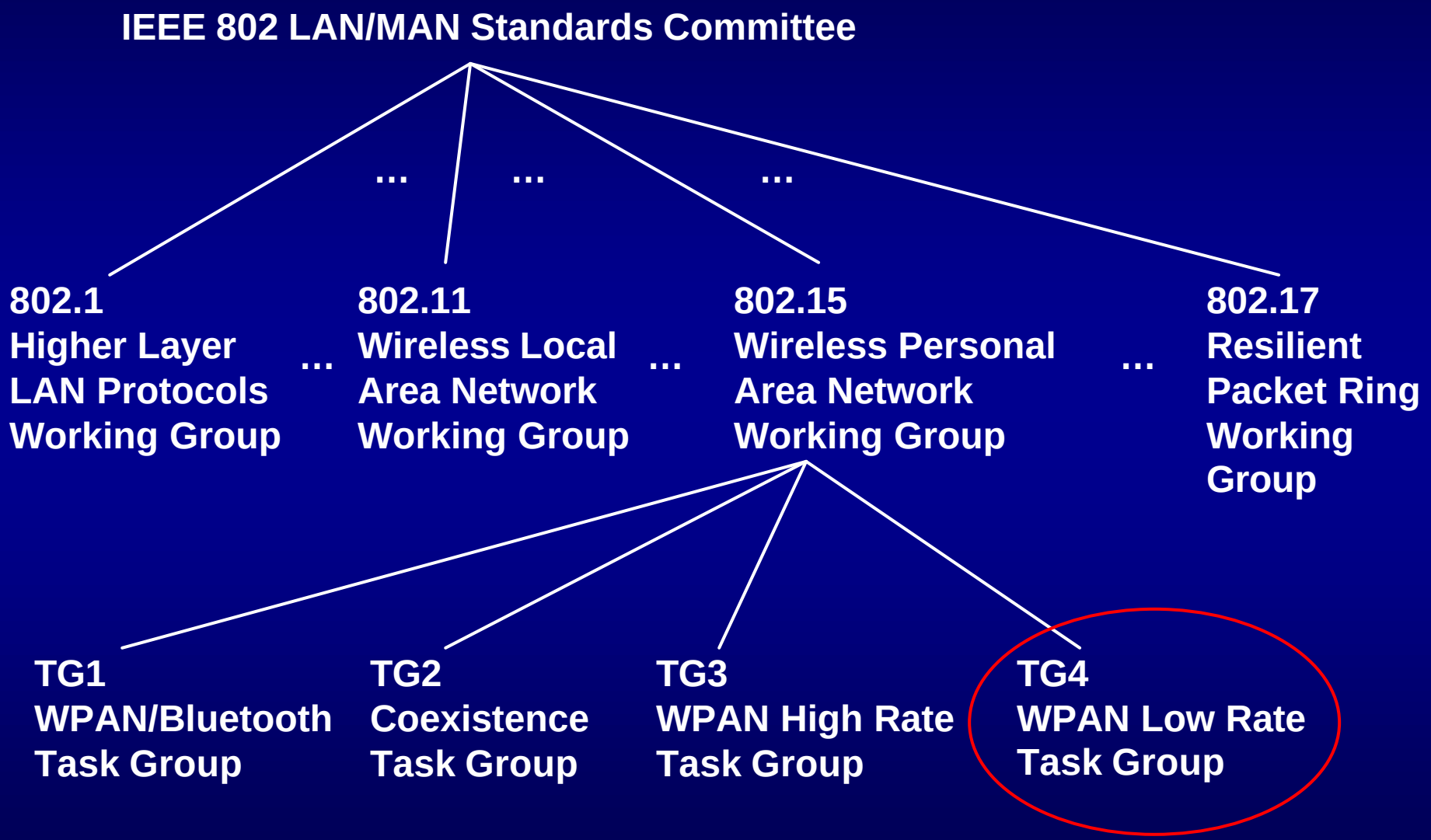
IEEE What?


IEEE 802 LAN/MAN Standards Committee
802.1
Higher Layer
LAN Protocols
Working Group
802.11
Wireless Local
Area Network
Working Group
802.15
Wireless Personal
Area Network
Working Group
802.17
Resilient
Packet Ring
Working
Group
TG1
WPAN/Bluetooth
Task Group
TG2
Coexistence
Task Group
TG3
WPAN High Rate
Task Group
TG4
WPAN Low Rate
Task Group

Now in Development …

A low-rate wireless personal area network communications protocol that:

-Supports multiple network types,

-Has long battery life (months or years from a AAA cell)

-Is low cost

For systems with moderate data throughput (< 250 kb/s) and QoS requirements.

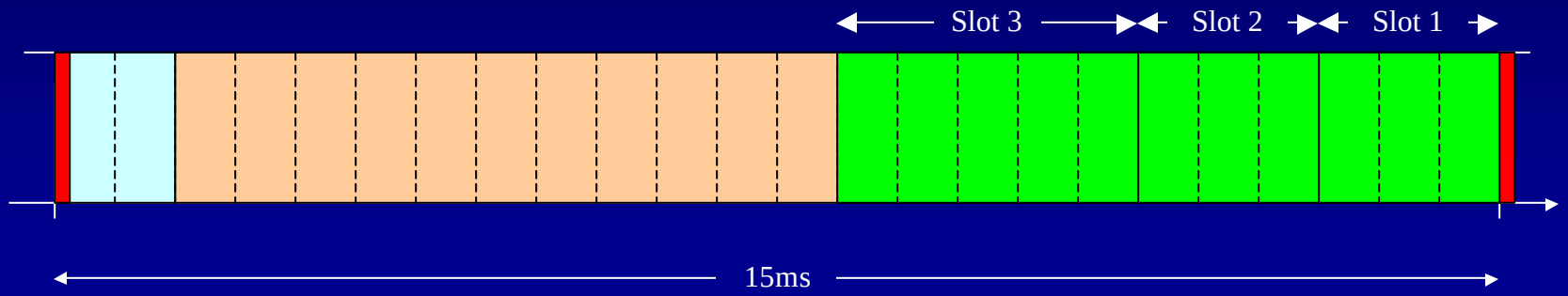
MAC Features

- Supports star & peer-peer topologies
  - Master/slave, point to any point, cluster tree, etc.
- Access is slotted CSMA-CA
- Data rates of 31.25 kb/s & 250 kb/s
- Optional use of network beacons
- Optional time slots for low latency transfer
- Super-frame is contention based

Node Types

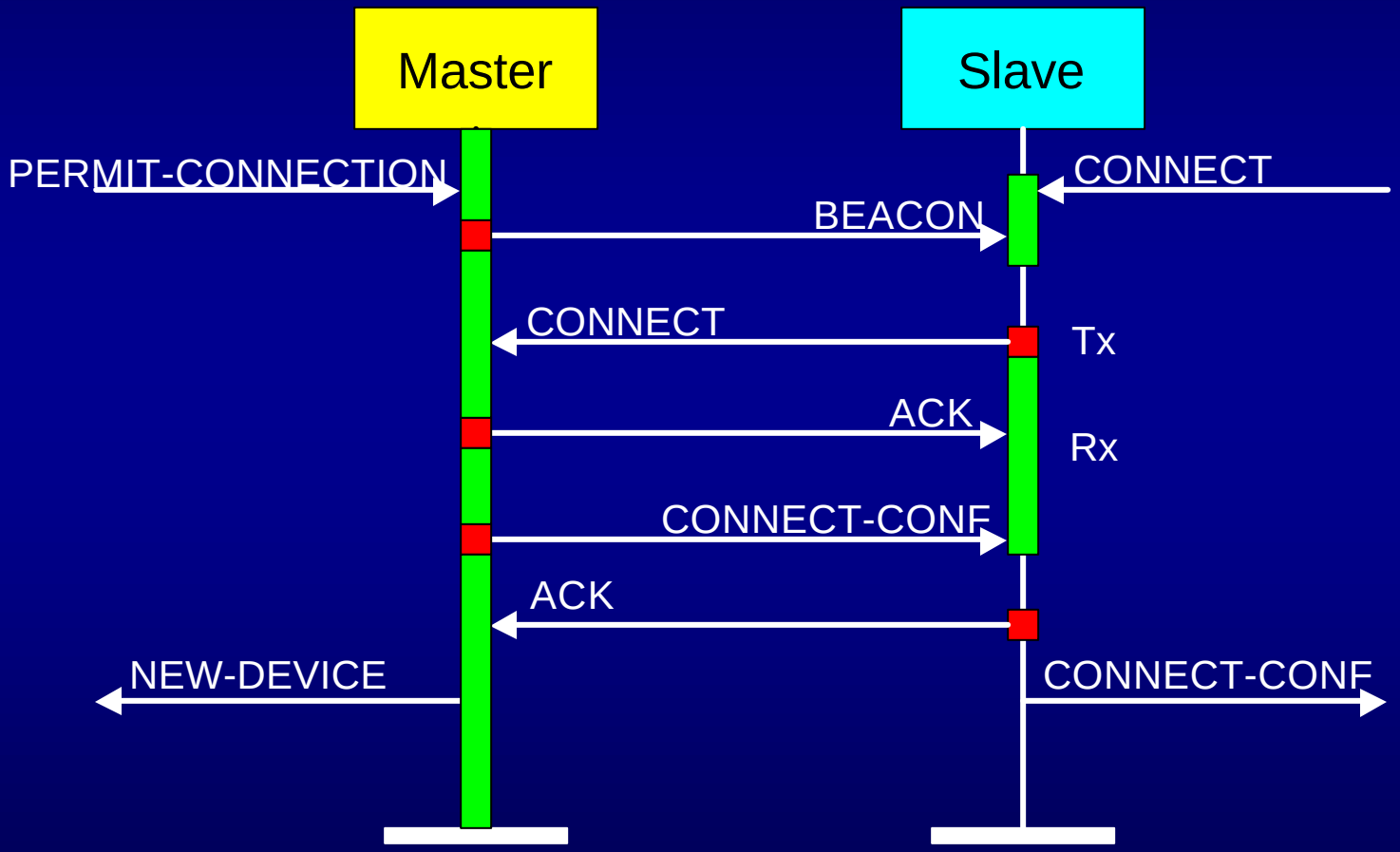
- Distribution node
  - Controls the network topology at that node
  - Master/coordinator or mediation device
    - Stores routing information
  - Talks to other distribution and slave nodes
- Slave node
  - Cannot control the network
  - Very simple implementation
    - Does not store routing information
  - Talks only to a distribution node

Optional Super Frame Structure

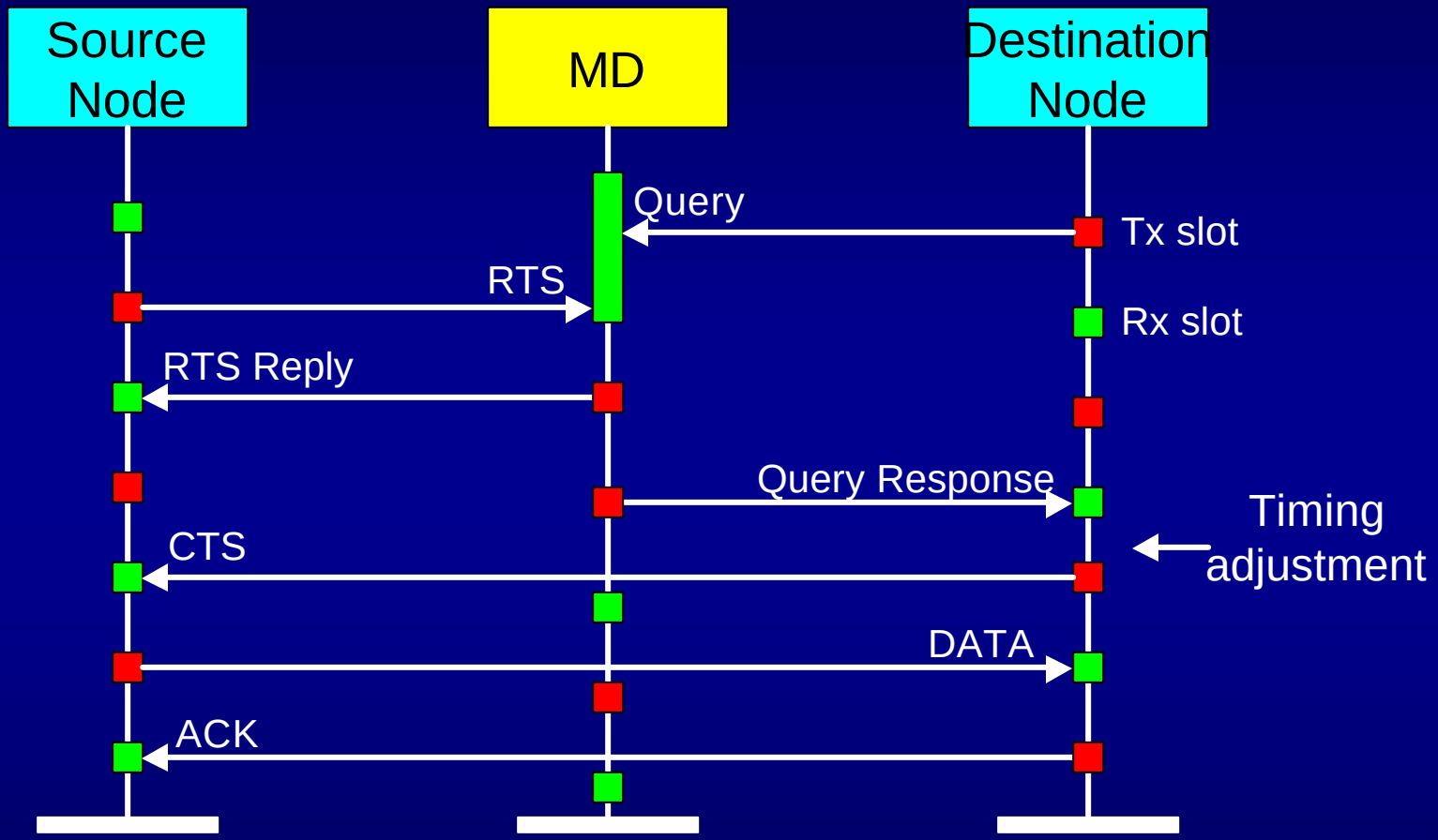


Network beacon	Transmitted by distribution nodes. Contains network information, super frame structure and notification of pending node messages.
Beacon extension period	Space reserved for beacon growth due to pending node messages
Contention period	Access by any node using CSMA-CA
Allocated slot	Reserved for nodes requiring guaranteed bandwidth.

Master/Slave: Network Connection



Mediation Device Operation



… Solves synchronization problem for low cost, low duty cycle peer-peer systems

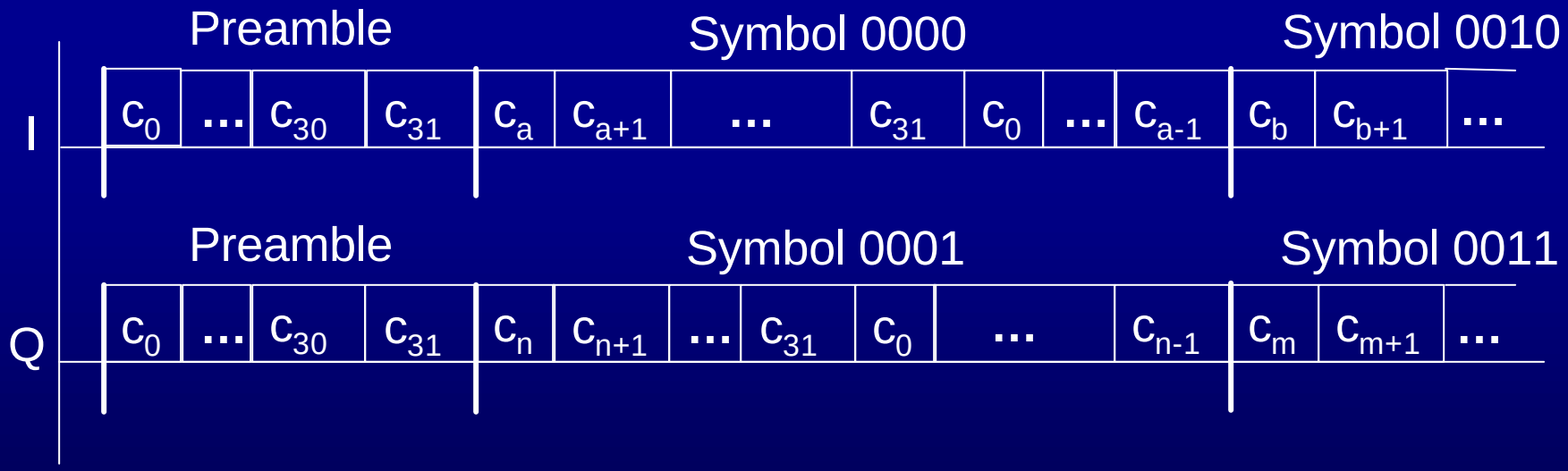
PHY Features

- 31.25 and 250 kb/s operation
- DSSS with low chip rate (1 MHz) for low power operation
- O-QPSK, for constant envelope modulation
  - Simple, low-cost PA
- Orthogonal coding
  - Greater range for a given output power
- 5 MHz channel separation
  - 16 channels in the 2.4 GHz band
  - 5 channels in the U.S. 915 MHz band
  - 1 channel (at lower data rates) in the European 866 MHz band
  - Eases channel filter requirements to lower die size & cost

Principle of Code Phase Shift Keying

The starting position of a single pn sequence is modulated with the transmitted data

- **Multiple bits may be sent in a single symbol time → better battery life**



For Further Information

- The IEEE 802.15.4 web site: http://www.ieee802.org/15/pub/TG4.html